ONTARIO MINISTRY OF ENVIRONMENT
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ONTARIO WATER
RESOURCES COMMISSION

ANNUAL REPORT 1964

RICHMOND HILL

water pollution control plant

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1964
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DIVISION OF PLANT OPERATIONS

Ontario Water Resources Commission

TD
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.A56
R53
1964

Richmond Hill : water pollution
control plant.
81845

ONTARIO WATER RESOURCES COMMISSION
OFFICE OF THE GENERAL MANAGER

Members of the Richmond Hill Local Advisory Committee,
Town of Richmond Hill.

Gentlemen:

We are pleased to provide you with the 1964 Operating Report for the Richmond Hill Water Pollution Control Plant, OWRC Project No. 57-S-6.

By continuing the mutual cooperation which has existed in the past, we can look forward to greater progress in the field of water pollution control.

Yours very truly,

D S Caverly

D. S. Caverly, P. Eng.,
General Manager

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General Manager,
Ontario Water Resources Commission.

Gentlemen:

It is with pleasure that I present to you the Annual Report of the operation of the Richmond Hill Water Pollution Control Plant, OWRC Project No. 57-S-6 for 1964.

This report presents design data, outlines operating problems encountered and summarizes in tables, charts and graphs all significant flow and cost data.

Yours very truly,

B C Palmer

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

This report describes the operation of this project for the year 1964. It includes a detailed description of the project, summary of operation, graphs and charts showing quality and quantity information, and project cost data.

This information will be of value to the municipality in assessing the adequacy of the works in meeting existing requirements and in projecting its capability to meet future expected demands. The cost information will be of particular interest to those concerned with developing and maintaining revenue structures.

The preparation of this report has been a cooperative effort of several groups within the Division of Plant Operations. These include the Statistical Section, Brochures Officer and the Regional Supervisor. However, the primary responsibility for the content has been with the Regional Operations Engineer. He will be pleased to discuss all aspects of this report with the municipality.

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

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RICHMOND HILL

water pollution control plant

operated for

THE TOWN OF RICHMOND HILL

by the

ONTARIO WATER RESOURCES COMMISSION

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DIRECTOR: B. C. Palmer

Assistant Director: C. W. Perry
Regional Supervisor: A. C. Beattie
Operations Engineer: A. Clark

801 Bay Street Toronto 5

'64 REVIEW

This report gives in detail significant data on the operation of the various treatment units at the Richmond Hill Water Pollution Control Plant.

The cost of operating the plant during 1964 was higher than 1963. The cost of treatment, however, was $108.10 per million gallons, a reduction of $21.00 per million over the previous year.

With an average daily flow of 1.29 mg the plant is below its design capacity of 1.6 mgd. However, the daily average flow is increasing steadily each year, and if the trend continues the plant will be operating at capacity by the spring of 1966.

There had been complaints in previous years about odours from the plant but chlorination of the raw sewage at three of the municipal sewage pumping stations all but eliminated the odours at the plant.

GLOSSARY

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

HISTORY

1951 – 1964

The present plant consists of three activated sludge treatment units in parallel and a common influent works. These three sections were completed in three separate stages. The first stage consisted of a primary sedimentation tank, aeration tanks, secondary sedimentation tank, digester and sludge drying beds. This original plant was rated at 180,000 gallons per day and was completed in 1951. The second stage was completed in 1956 and represented an increase in the treatment capacity of 450,000 gallons per day.

The final addition to the plant was completed in 1958. At this time, an additional digester was added as well as an extension to the sludge drying beds. The plant is now able to employ two stage digestion. This extension increased the capacity of the sewage treatment plant by 970,000 gallons per day, and included the building of an influent works which serves each of the three sections. The influent works consists of coarse screens, an aerated grit chamber and a barminutor. From there the sewage flow is split between the three sections. Any one section can be bypassed by closing a gate on the inlet to the primary sedimentation tank of that section.

The two extensions to the plant over the relatively short period since 1951 have resulted from a rapid increase in population over the past twelve years. The design population for the 1951 plant was 3,000 people. The two following design populations were 6,000 and 16,350.

The present plant is now capable of giving complete treatment to 1,600,000 gallons of sewage per day.

S. TOYE
CHIEF OPERATOR

Project Staff

S. Toye, Chief Operator at the Richmond Hill plant, joined the OWRC as an operator at the North Bay plant. In September, 1961, he was transferred to Richmond Hill. Mr. Toye received a Certificate of Qualification as a Sewage Works Operator after completing the series of instruction courses sponsored by the OWRC.

Other staff members and the starting date of their employment are:

R. H. Dennis, Operator	March 1960
G. Karsh, Operator	June 1964

Description of Project

INFLUENT

The waste water enters the plant by means of three sewers - two eight inch diameter sewers along Markham Road and one eighteen inch diameter sewer from Pugsley Avenue.

The raw sewage first passes through a coarse bar screen to remove large objects and then flows to an aerated grit chamber where the velocity of flow is reduced sufficiently to allow grit and detritus material, which may damage plant machinery, to settle out. The air introduced in the chamber produces a roll which allows grit to settle out while keeping the organic material in suspension.

From the grit chamber the flow passes through a barminutor which screens and shreds the large particles to a size suitable for handling in the treatment units. From this point, the flow enters a flow division box where it may be proportioned among the four primary sedimentation tanks.

PRIMARY SEDIMENTATION

The primary sedimentation tanks are designed to provide an adequate detention period to allow the heavier solids to settle out, and for the removal of surface scum and grease. The heavier solids which settle out to the bottom of the tank and surface scum are collected by a scraper mechanism and withdrawn to a sludge pit from where it is pumped to the primary digester.

The primary sedimentation tanks are designed to provide sufficient detention to allow removal of 30-35% of the heavy organic material.

The settled waste water flows over the effluent weirs and discharges to the aeration tanks.

AERATION

Settled sewage flows from the primary sedimentation tanks to the four aeration sections. There it is mixed with activated sludge which is returned from the final sedimentation tanks and aerated.

The aeration sections retain the sewage for 6 hours at a flow of 1.6 million gallongs per day. Air is supplied by three blowers with a total capacity of 1,440 cubic feet of air per minute.

FINAL SEDIMENTATION

The aerated mixed liquor from the aeration sections is retained in four final sedimentation tanks for approximately two hours at design flow. This allows the activated sludge to settle. It is collected from the bottoms of the tanks and returned to the aeration sections. (Excess activated sludge is returned to the primary sedimentation tanks and is pumped from there to the digesters.) The remaining liquid flows over the weirs of the final sedimentation tanks to the chlorine contact chambers.

DIGESTION

Sludge digestion in this plant is performed in two stages called primary and secondary digestion.

The sludge from the primary tanks is pumped, with excess activated sludge to the primary digester. In the absence of air, and in a regulated temperature of 90° F., the decomposing or digestion process begins. Constant agitation within the tank insures overall treatment.

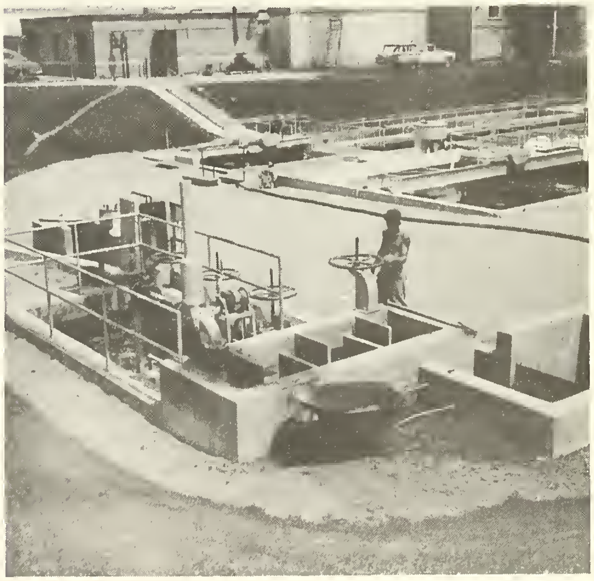
The raw sludge is broken down by anaerobic bacterial action and, when thoroughly digested, is a thick, dark, odourless liquid.

The secondary digester receives the digested material from the primary and completes the process. The secondary digester is not agitated but is allowed to be quiescent. The supernatant is decanted and returned to the treatment process.

Sludge gas, principally methane, formed during the process, is used as a fuel for the heat exchanger and boiler supplying heat to the digester and buildings. Oil is used as standby fuel.

CHLORINATION

From the final sedimentation tanks, the effluent flows to two chlorine contact chambers where it is chlorinated to reduce the bacterial count to within acceptable limits. It is then discharged to the creek.



INFLUENT WORKS

PROJECT COSTS

LONG TERM DEBT: (Total Capital Cost)	$359,420.00

The total cost to the municipality during 1964 was as follows:

Net Operating	$ 51,048.81
Debt Retirement	7,253.00
Reserve	2,982.00
Interest Charged	20,221.12
TOTAL	$ 81,504.93

RESERVE ACCOUNT

Balance at January 1, 1964	$ 18,381.90
Deposited by Municipality	2,982.00
Interest Earned	1,077.54
	$ 22,441.44
Less Expenditures	-
Balance at December 31, 1964	$ 22,441.44

DEBT OUTSTANDING:	$308,550.77

MONTHLY COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	*SUNDRY
JAN	3585.43	1369.74	267.44	112.40	432.64		67.21	54.01		1290.99
FEB	3538.57	1317.74	294.00	122.10	426.52	2.06	59.27	28.65	250.03	1038.20
MARCH	3961.23	1276.12	280.80	123.81	515.65	578.23	32.80		278.27	875.55
APRIL	2522.58	949.08	350.26	157.76	580.49	273.06	117.02	42.38	14.94	37.59
MAY	6981.82	1662.30	712.07	168.63	511.51	1372.09	26.00	9.87	798.35	1721.00
JUNE	5854.88	1685.17	431.69	104.15	527.23	1372.09	164.50		367.91	1202.14
JULY	5492.47	1954.16	279.66	92.20	504.23	2005.45	147.20		162.74	346.83
AUG	4376.34	1357.62	259.44	95.20	492.44	584.33	71.15	17.46	68.06	1430.64
SEPT	1861.16	1140.86	193.29	34.79	496.70	(1183.28)	35.63	24.84	34.85	1083.48
OCT	3918.07	1115.60	214.57	33.47	486.66	893.83	48.79	8.74	50.87	1065.54
NOV	3102.87	1082.78	283.76	50.26	510.49	(111.94)	72.74		12.38	1202.40
DEC	5853.39	1606.98	427.39	47.27	1094.08	(321.95)	169.31		27.81	2802.50
TOTAL	51048.81	16518.15	3994.37	1142.04	6569.64	5463.97	1011.62	185.95	2066.21	14096.86

* SUNDRY INCLUDES SLUDGE HAULING COSTS WHICH WERE $13,467

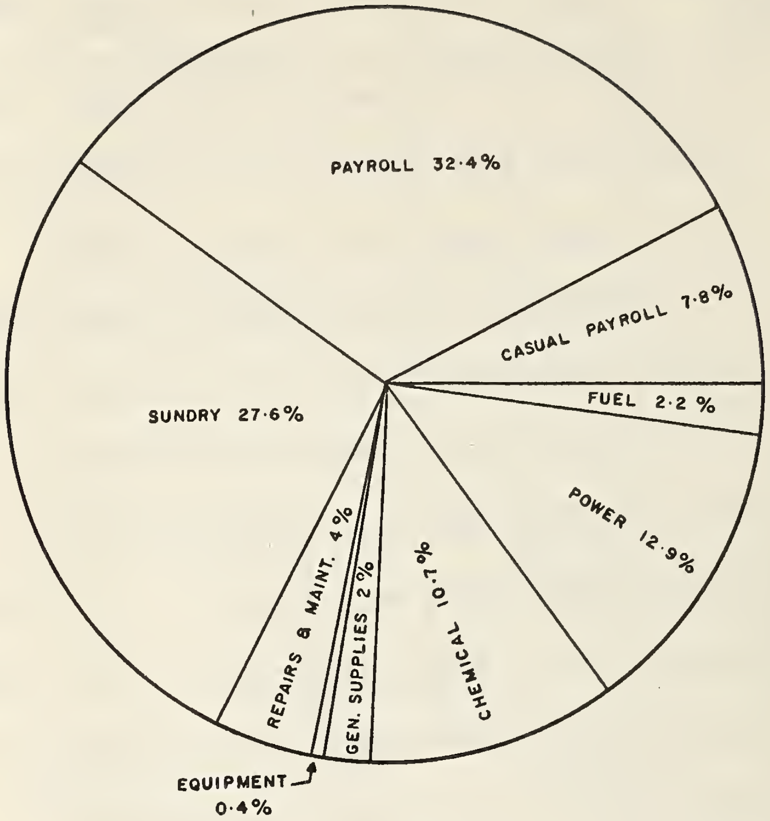
BRACKETS INDICATE CREDIT

YEARLY COSTS

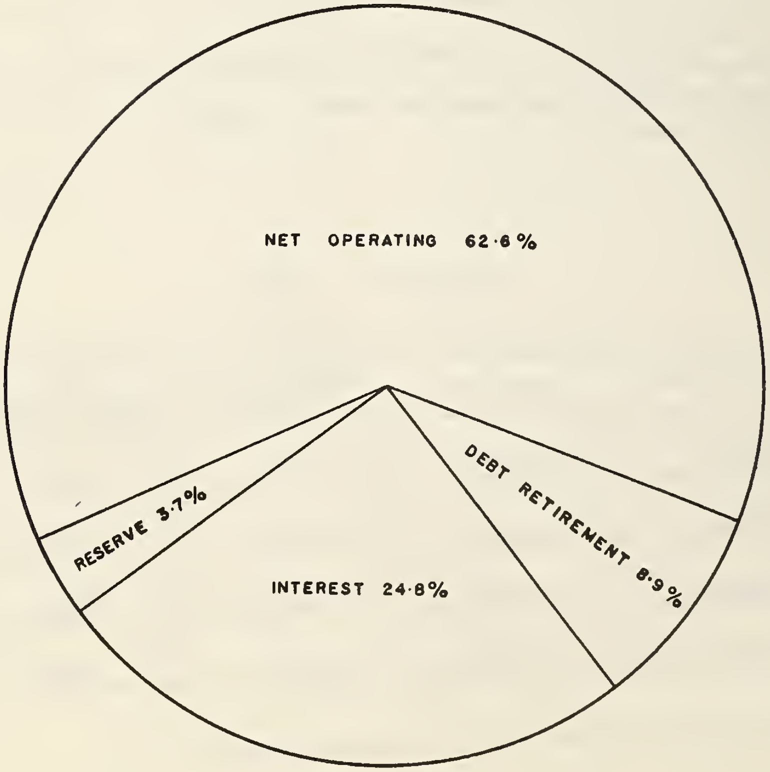
YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1961	205.53	44,475	9.32	216.50	14 2/3 CENTS
1962	316.02	44,420	9.32	140.50	7 1/2 CENTS
1963	331.36	42,954	9.01	129.50	6 CENTS
1964	472.211	51,049	10.69	108.10	6 CENTS

* BASED ON ANNUAL POPULATION ESTIMATE AND 3.9 PERSONS PER FAMILY

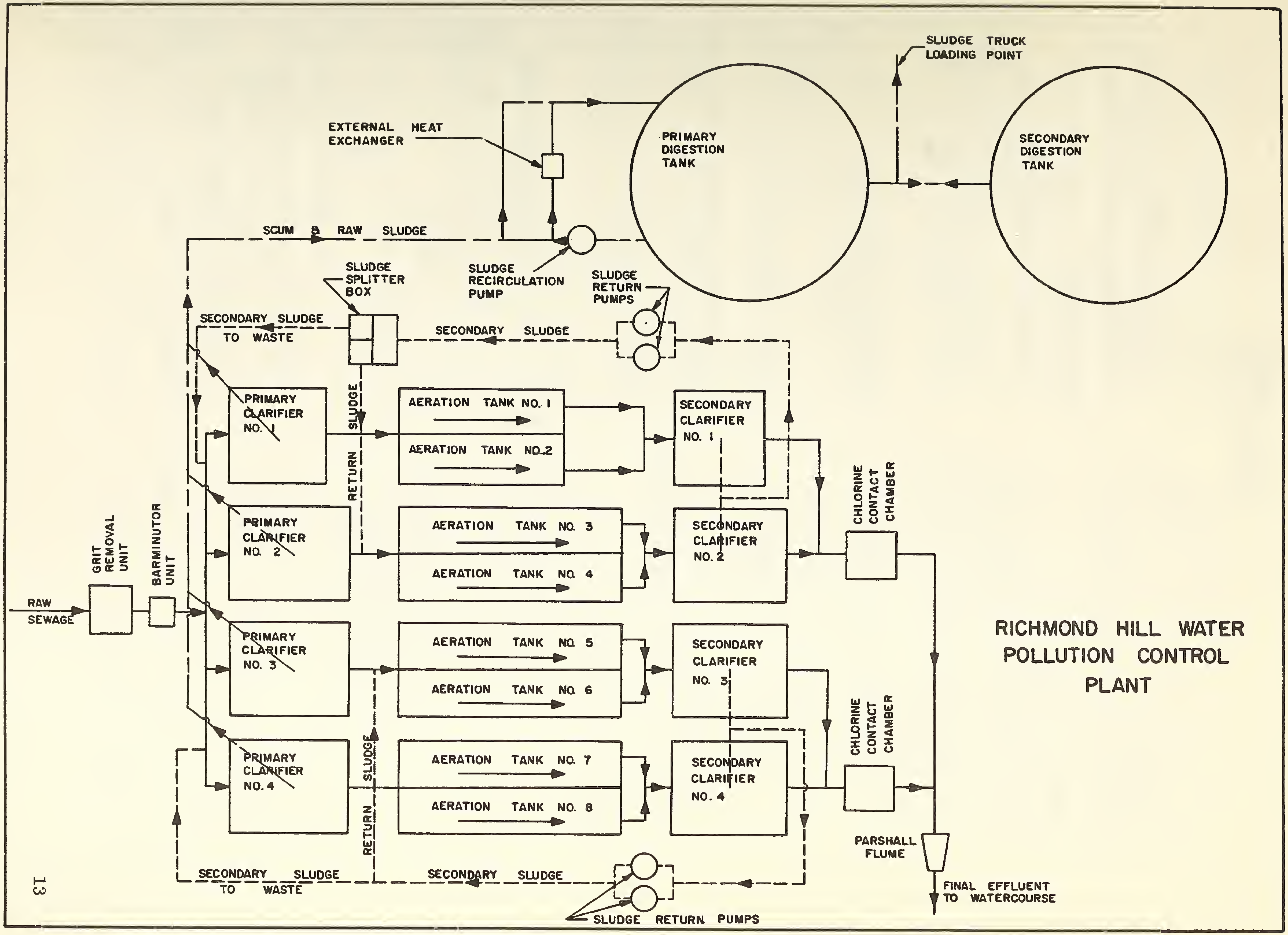
1964 OPERATING COSTS



TOTAL ANNUAL COST



Technical Section



RICHMOND HILL WATER POLLUTION CONTROL PLANT

Design—Data

GENERAL

Type of Plant - Activated sludge.

Design Population - 16,000.

Design Plant Flow - 1,600,000 gallons per day.

Per Capita Flow - 100 gallons per day.

Five Day BOD -

Raw Sewage	-	200 PPM
Removal	-	90%

Suspended Solids -

Raw Sewage	-	220 PPM
Removal	-	95%

COARSE SCREEN

1 inch x 0.25 inches at approximately 3 inch centres.

AERATED GRIT TANK

Size - 15.5 ft. x 6 ft. x 9 ft. (SWD).

Volume - 837 cubic feet or 5,220 gallons.

Retention - 4.7 minutes at 1.6 MGD.

Channel - Grit decanting trough (baffled).
- 8.75 ft. x 3 ft. x 2.25 ft. (top of concrete).
- 5 round-the-end baffles and adjustable weir overflow.

SHREDDER

Barminutor - Chicago Pump Company Model B-18 inch.

FLOW DIVISION BOX

8 inch diameter pipe to 1951 section.

12 inch diameter pipe to 1955 section.

15 inch diameter pipe to 1957 section.

1951 PLANT

PRIMARY SEDIMENTATION TANK

Size - 16 ft. diameter x 10 ft. SWD.

Volume - 2010 cubic feet, or 12,550 gallons.

AERATION TANKS

Size - 2 each 58 ft. x 9 ft. x 9 ft. liquid depth.

Volume - 4700 cubic feet each or 58,600 gallons (total).

SECONDARY SEDIMENTATION TANK

Size - 19 ft. diameter x 10 ft. SWD.

Volume - 2835 cubic feet or 17,680 gallons.

1955 EXTENSION

PRIMARY SEDIMENTATION TANK

Size - 26 ft. diameter x 10 ft. SWD.

Volume - 5310 cubic feet or 33,100 gallons.

AERATION TANKS

Size - 2 each 81 ft. x 14.5 ft. x 10.25 ft. liquid depth.

Volume - 12,030 cubic feet each or 150,000 gallons (total).

SECONDARY SEDIMENTATION TANK

Size - 30 ft. diameter or 10 ft. SWD.

Volume - 7,060 cubic feet or 44,100 gallons.

CHLORINE CONTACT CHAMBER

Size - 25 ft. x 10 ft. x 8 ft. liquid depth.

Volume - 2,000 cubic feet or 12,500 gallons.

1957 EXTENSION

PRIMARY SEDIMENTATION TANK

Size - 2 each 26 ft. diameter x 9.7 ft. SWD.

Volume - 5,150 cubic feet each or 64,350 gallons (total).

AERATION TANKS

Size - 4 each 81 ft. x 14.5 ft. x 9.35 ft. SWD.

Volume - 10,980 cubic feet each or 274,000 gallons (total).

SECONDARY SEDIMENTATION TANK

Size - 2 each 30 ft. diameter x 9.67 ft. SWD.

Volume - 6,840 cubic feet each or 85,400 gallons (total).

CHLORINE CONTACT CHAMBER

Size - 25 ft. x 10 ft. x 8 ft. liquid depth.

Volume - 2,000 cubic feet or 12,500 gallons.

OVERALL PLANT

PRIMARY SEDIMENTATION TANKS

Volume - 12,550 (1) + 33,100 (2) + 64,350 (3&4) = 110,000 gallons.

Retention - 1.65 hours at 1.6 MGD.

Surface Settling Rate - 908 gallons per square ft. per day at 1.6 MGD.

Weir Overflow Rate - 4,880 gallons per lineal ft. of weir per day at 1.6 MGD.

AERATION TANKS

Volume - 58,600 (1) + 150,100 (2) + 274,000 (3&4)= 482,700 gallons

Retention - 7.25 hours at 1.6 MGD (no return sludge).

- 5.9 hours at 1.6 MGD plus 25% return sludge.

SECONDARY SEDIMENTATION TANKS

Volume - 17,680 (1) + 44,100 (2) + 85,400 (3&4) = 147,180 gallons.

Retention - 2.21 hours at 1.6 MGD or 1.77 hours at 2.0 MGD.

Surface Settling Rate - 667 gallons per square ft. per day at 1.6 MGD.

Weir Overflow Rate - 4,120 gallons per lineal ft. of weir per day at 1.6 MGD.

CHLORINE CONTACT CHAMBERS

Volume - 12,500 (2) + 12,500 (3&4) = 25,000 gallons.

Retention - 22.5 minutes at 1.6 MGD.

SLUDGE DIGESTERS

Size (1951) - 30 ft. diameter x 19 ft. SWD.

Volume - 13,430 cubic feet.

Size (1957) - 50 ft. diameter x 20 ft. SWD.

Volume - 39,200 cubic feet.

TOTAL

Volume - 52,630 cubic feet.

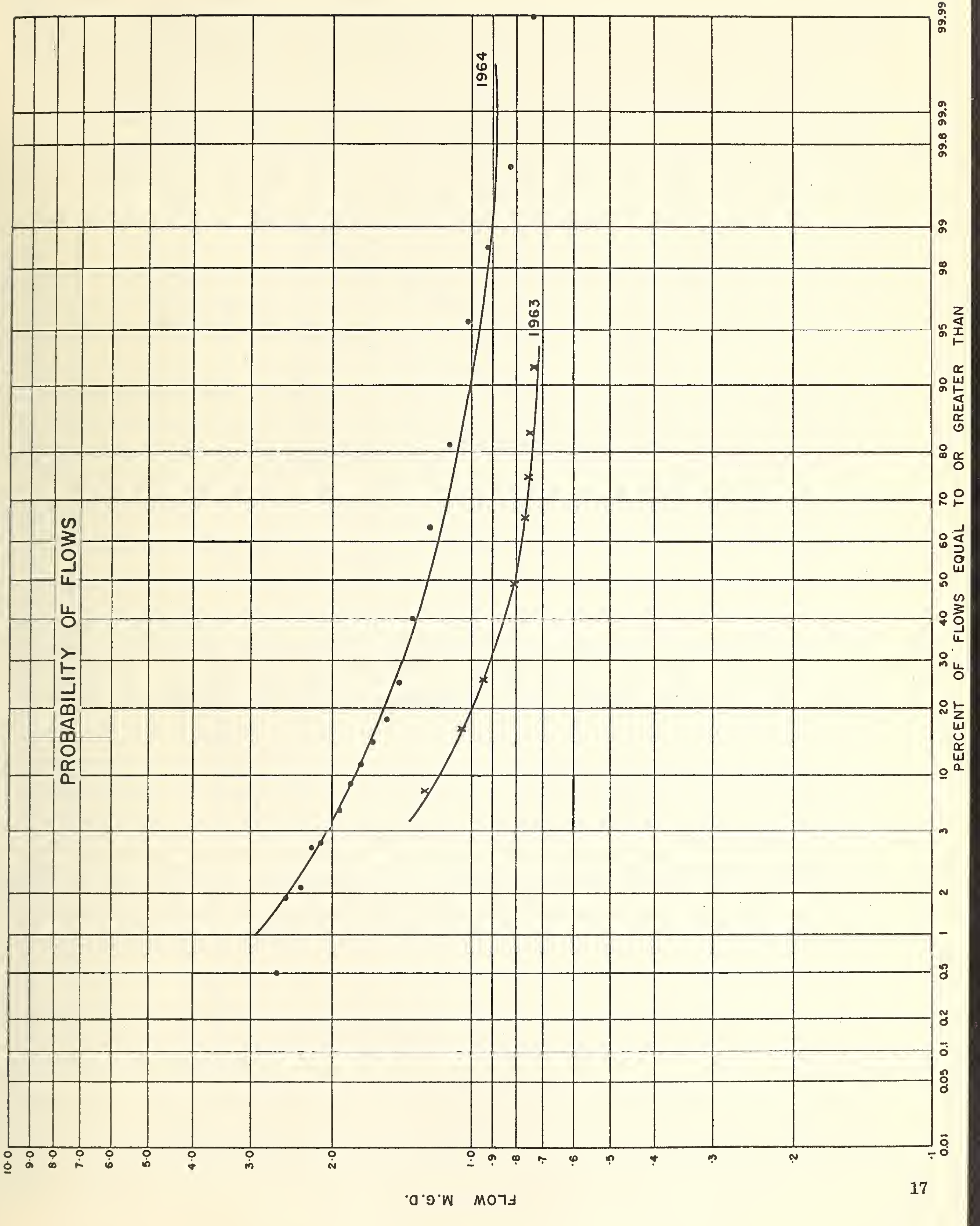
Capacity - 3.28 cubic feet per capita.

OUTFALL

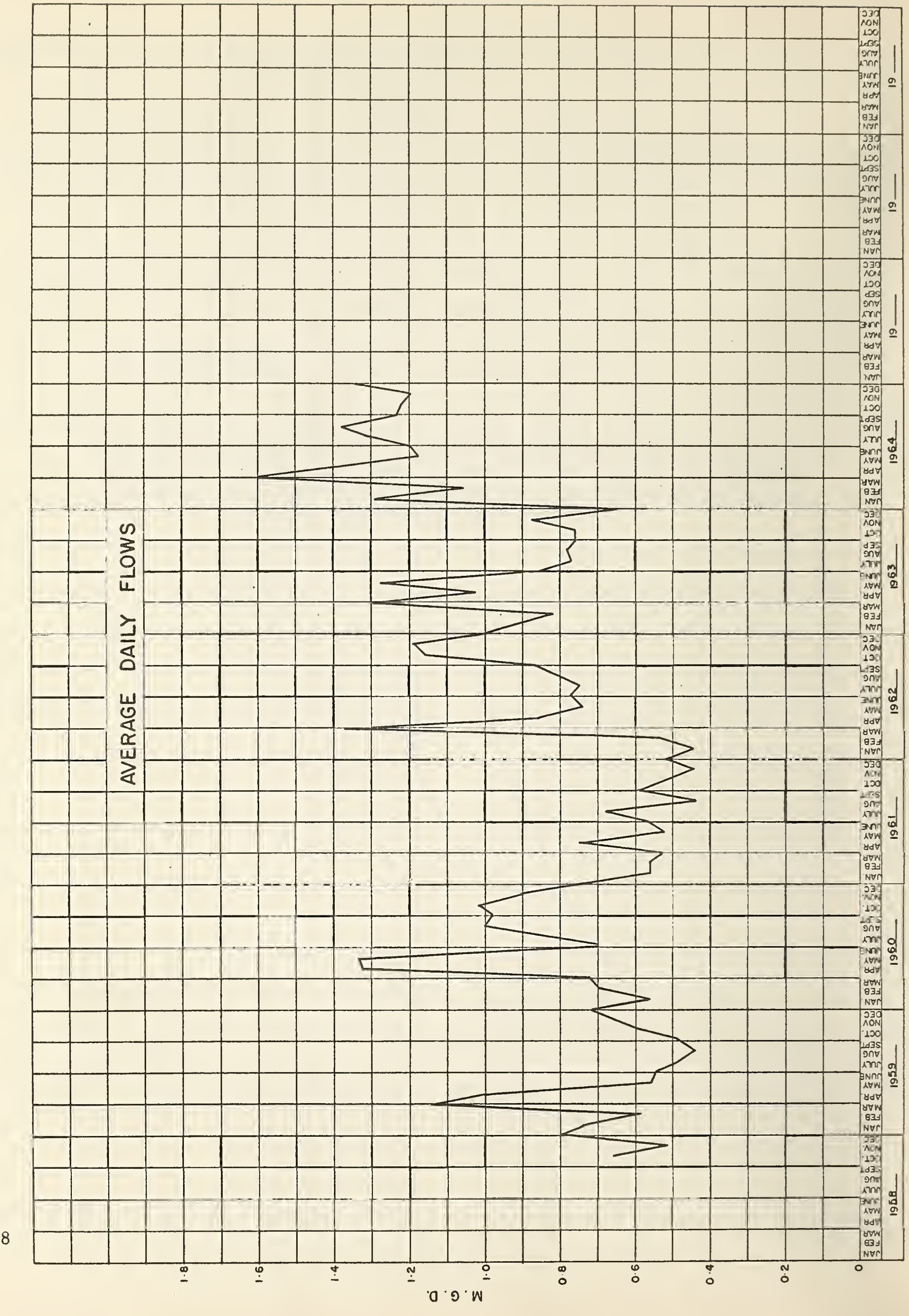
30 inch diameter concrete outfall sewer to German Mills Creek.

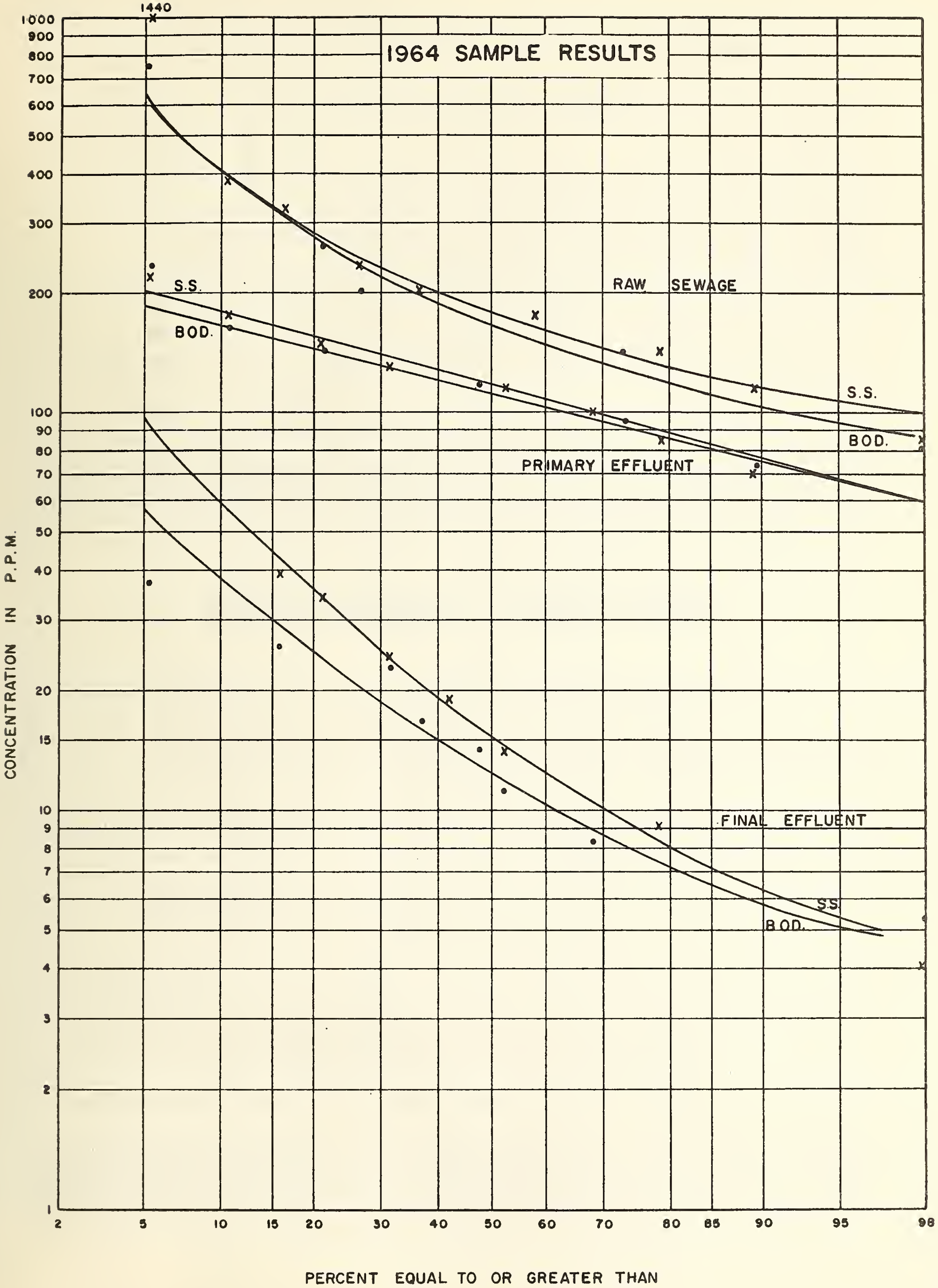
Process Data

As will be noted from following charts and graphs, the average daily flow and total flow for the year were significantly higher than 1963 flows. During 1964 the average daily flow was 1.290 mgd. This is an increase of 31% over 1963. During the year 472.211 mg were treated.



PROBABILITY OF FLOWS


AVERAGE DAILY FLOWS
M.G.D.
0
0·2
0·4
0·6
0·8
1·0
1·2
1·4
1·6
1·8
JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC
1958
1959
1960
1961
1962
1963
1964
19
19
19


1964 SAMPLE RESULTS
1440
RAW SEWAGE
S.S.
BOD.
S.S.
BOD.
PRIMARY EFFLUENT
FINAL EFFLUENT
S.S.
BOD.
CONCENTRATION IN P.P.M.
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
4
3
2
1
2
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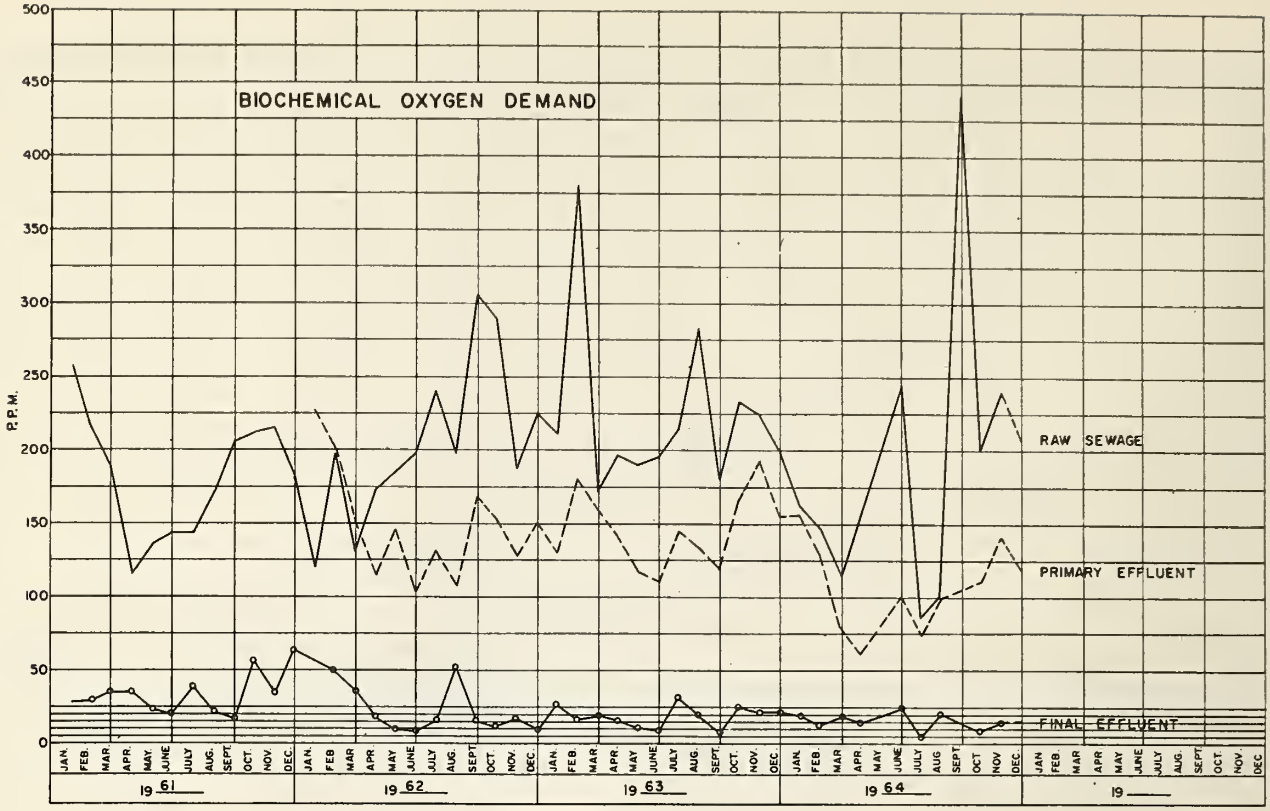
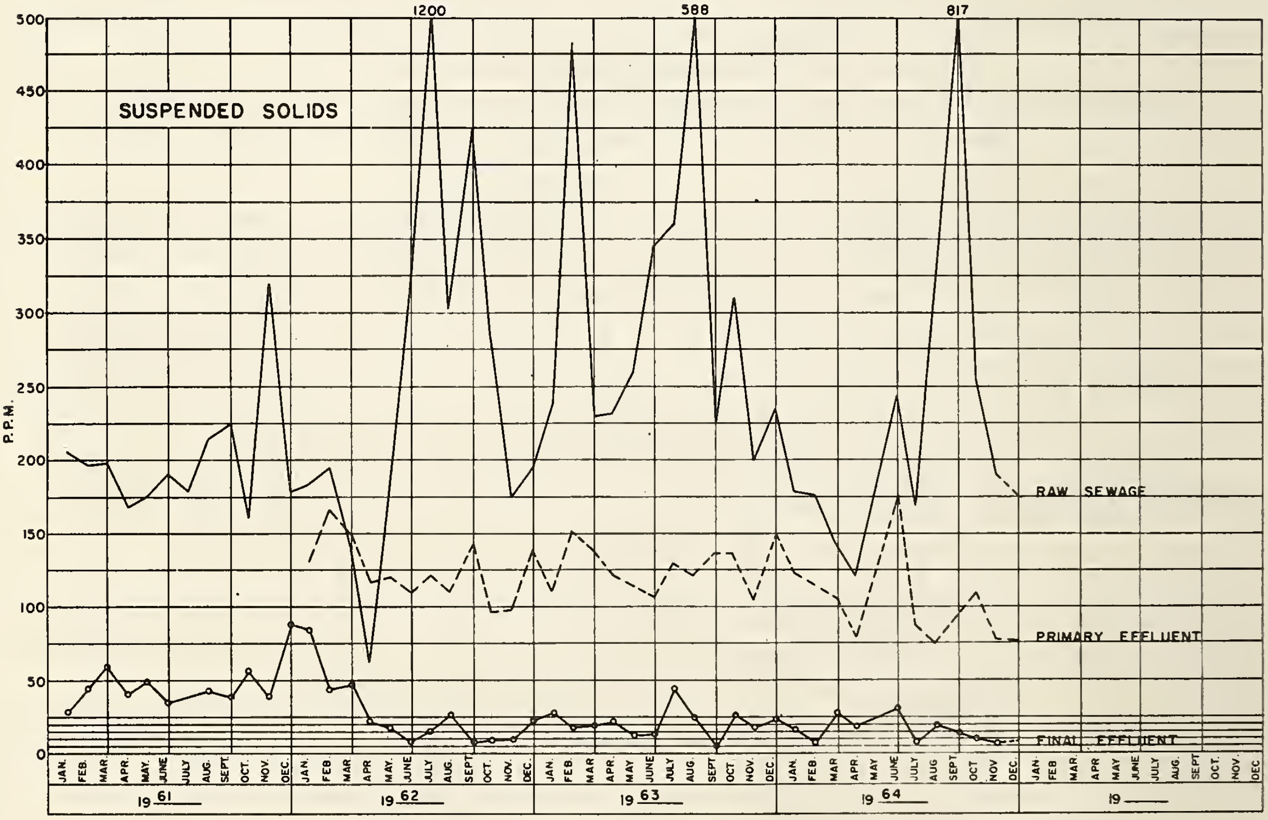
15
20
30
40
50
60
70
80
85
90
95
98
PERCENT EQUAL TO OR GREATER THAN



MONTHLY VARIATIONS



GRIT, B.O.D AND S.S. REMOVAL

MONTH	B. O. D.				S. S.			
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED
JAN.	162	18	89	28.8	179	17	90.5	32.4
FEB.	147	10.9	92.5	20.7	178	7	96	26
MAR.	116	18	84.5	24.4	145	27	81.5	29.4
APR.	155	11	93	30.7	122	18	85	22.2
MAY	190 *	14	92.5	32.0	256	16	93.5	43.7
JUNE	160	24	85	24.5	244	32	87	38.2
JULY	84	3.7	95.5	16.4	172	7	96.0	33.7
AUG.	444	18	96.0	91.5	817	19	97.5	171.4
SEPT.	190 *	14	92.5	32.6	256	16	93.5	44.5
OCT.	200	7.9	96.0	36.6	254	8	97.0	46.8
NOV.	240	14	94.0	40.6	192	7	96.5	33.2
DEC.	190 *	14	92.5	36.8	256	16	93.5	50.1
TOTAL	-	-	-	415.5	-	-	-	566.6
AVG.	190	14	92.5	34.6	256	16	93.5	47.2

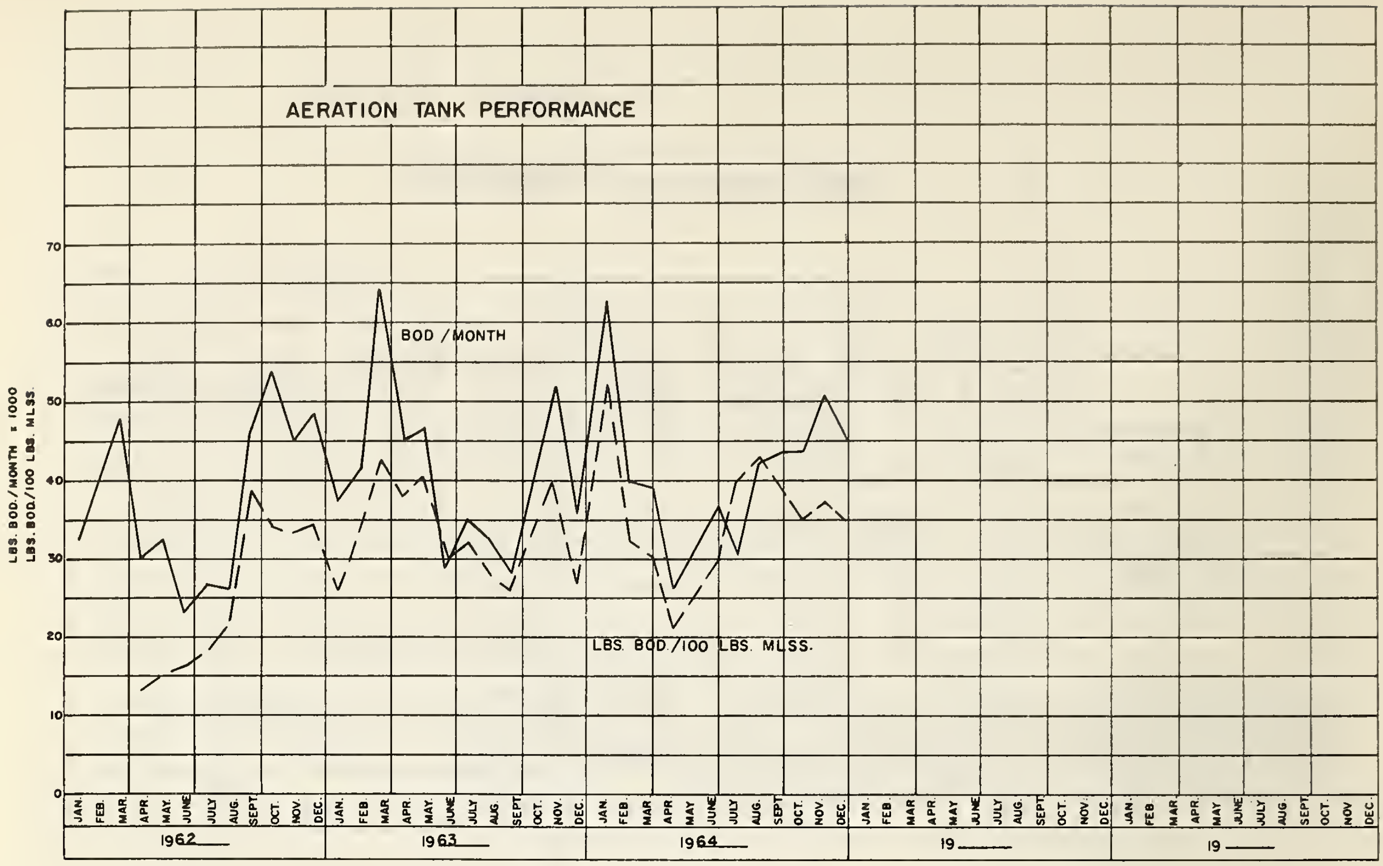
* AVERAGE VALUE SUBSTITUTED

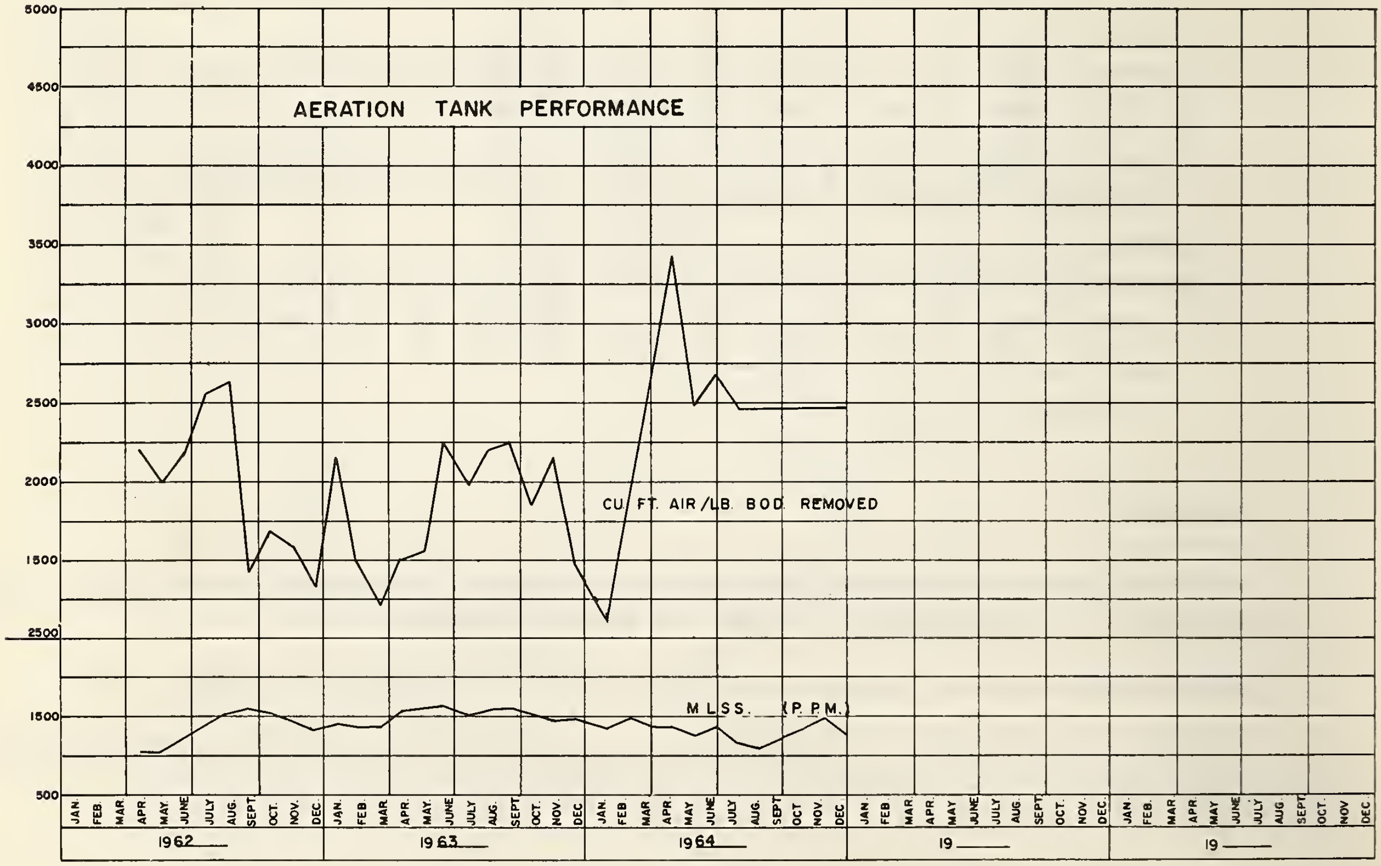
COMMENTS

An average loading of 190 ppm BOD and 256 ppm SS was experienced in raw sewage. The average BOD in the effluent of 14 ppm was within OWRC objectives.

The final effluent SS of 16 ppm was in excess of OWRC objectives by 1 ppm.

The efficiencies obtained, 92.5% for BOD removal and 93.5% for SS are most satisfactory.


AERATION TANK PERFORMANCE
LBS. BOD./MONTH x 1000
LBS. BOD/100 LBS. MLSS.
70
60
50
40
30
20
10
0
BOD /MONTH
LBS. BOD./100 LBS. MLSS.
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT. OCT. NOV. DEC.
1962
1963
1964
19
19


AERATION TANK PERFORMANCE
5000
4500
4000
3500
3000
2500
2000
1500
2500
1500
500
CU. FT. AIR/LB. BOD. REMOVED
MLSS. (P.P.M.)
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT. OCT. NOV. DEC.
1962
1963
1964
19
19

AERATION SECTION

MONTH	PRIM. EFFL. B.O.D. P.P.M.	M.L.S.S. P.P.M.	LBS. B.O.D. PER 100 LBS. M. L. S. S.	CUBIC FEET AIR PER LB. B.O.D. REMOVED
JANUARY	156	1323	52	1117
FEBRUARY	129	1409	32	1834
MARCH	78	1355	30	2607
APRIL	60	1359	21	3435
MAY	-	1249	-	-
JUNE	100	1348	29	2687
JULY	74	1153	40	1848
AUGUST	98	1097	43	2196
SEPTEMBER	-	1214	-	-
OCTOBER	114	1328	35	1891
NOVEMBER	140	1472	37	1669
DECEMBER	-	1286	-	-
TOTAL	-	-	-	-
AVERAGE	105	1300	35	2143

COMMENTS

The aeration capacity of the plant was increased slightly in 1964 by returning the 1951 section of the plant to operation. By doing this an additional 300 cfm of air was made available.

Additional air capacity will be made available before the summer of 1965 by the installation of a new 1000 cfm blower.

DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS			GAS PRODUCED 1000'S Cu. Ft.
	1000'S CU. FT.	% SOLIDS	% VOL. MAT.	1000'S CU. FT.	% SOLIDS	% VOL. MAT	
JAN.	40.54	3.56	-	13.62	1.98	-	-
FEB.	33.57	2.96	-	13.62	6.53	-	-
MAR.	43.99	3.09	-	20.51	2.20	-	-
APR.	45.51	2.15	-	22.56	1.60	-	-
MAY	52.00	-	-	22.56	-	-	-
JUNE	48.38	3.46	-	30.53	2.40	-	-
JULY	57.05	1.75	-	18.23	2.67	-	-
AUG.	58.97	2.98	-	18.23	1.82	-	-
SEPT.	57.45	-	-	22.60	-	-	-
OCT.	61.38	2.08	-	26.20	2.04	-	-
NOV.	61.38	3.14	-	30.53	3.10	-	-
DEC.	63.38	-	-	86.70	-	-	-
TOTAL	623.60	-	-	325.89	-	-	-
AVG.	51.97	2.80	-	27.16	2.70	-	-

COMMENTS

During the year 1964, a total of 3.90 million gallons of raw sludge was pumped to the digesters. At an average concentration of 2.8%,this represents a total of 1,090,000 pounds.

The quantity of sludge removed from the digesters during the year was 2.04 million gallons or 52% of total sludge to the digesters. Sludge disposal at Richmond Hill is by tank truck haulage.

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (P.P.M)
JANUARY	40.034	3000	7.49
FEBRUARY	30.469	2700	8.86
MARCH	49.909	2800	5.61
APRIL	42.662	2750	6.45
MAY	36.420	3100	8.51
JUNE	36.025	3369	9.35
JULY	40.904	3094	7.56
AUGUST	42.967	2625	6.11
SEPTEMBER	37.064	2416	6.52
OCTOBER	38.069	2734	7.18
NOVEMBER	35.929	2625	7.31
DECEMBER	41.759	2813	6.74
TOTAL	472.211	34026	-
AVERAGE	39.351	2836	7.21

COMMENTS

Chlorination was carried out throughout the year to reduce the bacterial count of the plant effluent. During the year, 34,026 pounds of chlorine were required to treat 472.21 million gallons. This represents an average dosage of 7.21 ppm.

MAR 3 - 1970
AUG 6 1971

ONTARIO WATER RESOURCES COMMISSION